## REMARKS/ARGUMENTS

Claims 1-7, 12-15 and 17-19 have been rejected under 35 USC 102(b) as anticipated by JP 3-240219 A ("JP '219"). Reconsideration and withdrawal of this rejection are requested in light of the following remarks.

Claim 1 is directed to a semiconductor wafer holding system for holding wafers in position within a transfer chamber during transfer of the wafers between an ambient atmosphere and an inspection chamber which is at vacuum pressure. The transfer chamber is interposed between the ambient atmosphere and the inspection chamber, and is subjected to alternating depressurization and repressurization. While it is within the transfer chamber, the wafer is held on a paddle having openings therein adapted to be covered by the wafer. The paddle is fixedly arranged in the transfer chamber. A drawing means is provided to inhibit motion of the wafer in the transfer chamber during at least one of the alternating pressurization and depressurization by providing a pressure differential for drawing the wafer to the wafer-receiving surface of the paddle.

In summary, some key features of the present invention include the following:

1. a transfer chamber for the wafers,
2. an inspection chamber which is at vacuum pressure,
3. the transfer chamber is subjected to alternating depressurization and represurrization,
4. the wafer is placed upon a paddle which is fixedly arranged in the transfer chamber, and
5. the drawing means inhibits motion of the wafer by applying a pressure differential during at least one of the alternating depressurization and repressurization of the transfer chamber.

The USPTO provided only an English abstract of JP '219. Applicant has obtained a translation of the entire document, and a copy is enclosed.

JP '219 discloses two mechanisms for holding down wafer 107, with one applying a negative pressure suction force and the other applying an electrostatic attractive force. As explained in detail on pages 7-9 of the enclosed English translation of JP '219, it performs the following sequence:

1. Evacuation chamber 104 is placed under atmospheric pressure.
2. Wafer 107 is placed on holder 108 within chamber 104.
3. Suction is applied to vent 301 to hold wafer 107 (**Note**: no evacuation yet of chamber 104).
4. More suction is applied to vent 302 to flatten wafer 107 (**Note**: no evacuation yet of chamber 104).
5. Electrostatic voltage is applied to electrode 305 so that wafer 107 is held on holder 108 by an electrostatic attractive force (**Note**: no evacuation yet of chamber 104).
6. As explained in the middle of page 9 of the translation, "Then, the gate valve 106 is closed, and the inside of the evacuation chamber 104 is evacuated by the evacuation pump 112."

Thus, it is clear that during depressurization of chamber 104, wafer 107 is held down by the electrostatic attraction force, not by the negative pressure suction force.

Claim 1, as amended herein, specifies that the drawing means inhibits "motion of the wafer in said transfer chamber during at least one of the alternating depressurization and repressurization, wherein said drawing means are arranged to provide a pressure at said openings which is lower than pressure prevailing in said transfer chamber." As is clearly evident from the explanation of JP '219 provided above, it holds down the wafer with an electrostatic attractive force during depressurization and, thus, does not anticipate claim 1.

Thus, claim 1 is clearly allowable over JP '219 under 35 USC 102 as well as under 35 USC 103.

Claims 3-9 and 12 are dependent upon claim 1, either directly or indirectly, and thus each is allowable therewith.

Independent claims 13 and 17 include the above-discussed distinctive features of the present invention and, therefore, are also allowable over JP '219.

Claims 14 and 15 depend from claim 17 and, thus, each is allowable therewith.

Claims 18 and 19 depend from claim 17 and, thus, each is allowable therewith.

Applicant gratefully acknowledges the allowance of claims 22-34.

Withdrawn claims 10 and 11 depend from allowable claim 1. Thus, a rejoinder of these claims is in order.

Claim 16 depends from allowable claim 13. Thus, a rejoinder of claim 16 is in order.

Claims 20 and 21 depend from allowable claim 17 and, thus, a rejoinder of these claims is in order.

Based on all of the above, it is respectfully submitted that the present application is now in proper condition for allowance. Prompt and favorable action to this effect and early passing of this application to issue are respectfully solicited.

Should the Examiner have any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

It is believed that no additional fees or charges are required at this time in connection with the present application. However, if any fees or charges are required at this time, they may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
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ABSTRACT:

PURPOSE: To increase the suction force of a thin tabular specimen to a holding part and to facilitate a mounting/dismounting of the specimen by a method wherein a negative pressure is caused in a space part, which is formed between the specimen and the holding part, the specimen is held by a negative pressure suction force and an electrostatic voltage is applied between the specimen and an electrode in the holding part.

CONSTITUTION: A wafer transfer robot 109 is actuated, a wafer 107 delivered from a wafer cassette 110 is placed on a holder 108 on a holder transfer arm 116, then, the holder 108 is placed on a holder table 111 in an exhaust chamber 104. Then, a vent hole 302 for wafer suction use in the table 111 and a ventilating flow path 303 in the holder 108 are evacuated, the pressure in the hole 302 and the flow path 303 is turned into a negative pressure and the wafer 107 is held on the holder 108 by a negative pressure suction force and is flattened with sufficient accuracy. After that, the table 111 is moved downward. Thereby, terminals 304 come into contact to terminals 306 and when an electrostatic voltage is applied to an electrode 305, the wafer 107 is held on the holder 108 by an electrostatic suction force and the suction force of the wafer to the holder is increased.

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審査請求　未請求　請求項の数 2　(全5頁)

⑤4発明の名称　試料装填装置及びその装填方法

⑳特　願　平2-37799

㉒出　願　平2(1990)2月19日

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## 明細書

1．発明の名称

試料装填装置及びその装填方法

2．特許請求の範囲

(1)薄板状試料と保持部との間に静電吸着力を生じさせるための電圧印加手段を設け、前記保持部に通気流路を形成し、該通気流路の一端側を前記試料に臨ませると共に、該通気流路の他端側に排気手段を連結したことを特徴とする試料装填装置。

(2)薄板状試料と保持部との間に形成される空間部に負圧を生じさせて該試料を該保持部に保持し、次いで、該試料と保持部内の電極との間に所定の大きさの静電電圧を印加することを特徴とする試料装填方法。

3．発明の詳細な説明

[産業上の利用分野]

本発明は、例えば薄板状試料たるウェハ上にLSIパタン等を描画するための電子ビーム露光装置、あるいはウェハに成膜やエッチング等のウェハ処理を行う半導体プロセス装置に搭載される試料装填装置に関するものである。

[従来の技術]

従来、例えば電子ビーム露光装置においては、真空下でウェハを加工処理するべく、試料ステージに対して該ウェハをバネ力あるいは静電吸着力により保持(いわゆる静電チャックによる保持)させるための試料装填装置を設けるようにしている。

[発明が解決しようとする課題]

しかしながら、かかる従来の試料装填装置では、バネ力あるいは静電吸着力のみを用いているので、ウェハを保持する力に限界があり、ウェハの単なる保持は可能であっても、ウェハが矯正を必要とするような反りを有する場合、その平坦化を行なうには十分な効果を発揮できない。

これは、ウェハを保持部に保持させる当初の状態、例えばウェハが減圧雰囲気下にあるか大気中にあるか、また保持当初のウェハの反りの程度、ウェハと保持部との間のダストの存在等によって

ウェハの保持に寄与する有効接触面積が大きく異なり、静電吸着力が大きく変動することに起因する。

例えば、静電吸着力のみを用いて試料保持を行うように構成された試料装填装置の場合、例えば6インチのウェハが保持前に、最大50μmの反りを有している場合、ウェハと保持部との間に静電吸着力を発生させるために例えば300Vを印加しても、最大40μm程度の反りに低減させ得るにすぎない。

さらに、かかる静電吸着力のみを用いた試料装填装置では、電圧印加を解除した後も静電チャック絶縁部に電荷が留まる結果、静電力が残留したり、分子間吸引力に基づくウェハと静電チャック間の吸着力の残留作用により、ウェハの保持部からの剥離が容易には行えない場合がある。

本発明は、上記課題を解決すべくなされたものであり、試料の保持部への吸着力を増大させることができ、試料の着脱も容易に行える等の試料装填装置及びその装填方法を提供することを目的とする。

[課題を解決するための手段]

上記目的を達成すべく、請求項1の発明は、薄板状試料と保持部との間に静電吸着力を生じさせるための静電電圧印加手段を設け、前記保持部に通気流路を形成し、該通気流路の一端側を前記試料に臨ませると共に、該通気流路の他端側に排気手段を連結したことを特徴とする。

また、請求項2の発明は、薄板状試料と保持部との間に形成される空間部に負圧を生じさせて該試料を該保持部に保持し、次いで、該試料と保持部内の電極との間に所定の静電電圧を印加することを特徴とする。

[作用]

本発明の構成では、典型的には、まず排気手段を作動させて通気流路内を負圧にし、薄板状試料と保持部との間に負圧吸着力を生じさせ、これにより保持部上の薄板状試料を平坦化する。次いで、薄板状試料と保持部との間に電圧を印加して静電吸着力を生じさせる。

その後、保持部から薄板状試料を剥離させるには、前記電圧の印加を解除し、さらに、通気流路内が正圧になるように排気手段を作動させる。

[実施例]

第1図は本発明に係る試料装填装置を搭載した電子ビーム露光装置の一例を示すものであり、該電子ビーム露光装置は薄板状試料たるウェハ107に直接描画を行うべく構成されている。

すなわち、除振台101上には、電子光学鏡筒102を有する真空容器103、排気室104ウェハ搬送ロボット109、ウェハカセット110等が設置されており、前記真空容器103と排気室104とはゲートバルブ105を介して連結され、該排気室104はゲートバルブ106を有し、前記真空容器103と排気室104との間はホルダ搬送アーム116が移動可能となっており、ウェハ搬送ロボット109はウェハカセット110とホルダ搬送アーム116との間でのウェハ107の受け渡しを行い得るように構成されている。

前記真空容器103には排気ポンプ115が連結されており、該真空容器103内には試料ステージ114が配設されている。また、排気室104には排気ポンプ112が連結されており、排気室104内にはホルダテーブル111が設けられ、該ホルダテーブル111上には保持部たるホルダ108を載置し得るようになっており、該ホルダ108には排気手段たる排気ポンプ113が連結されている。

なお、真空容器103内では試料ステージ114上に設置されたホルダ108上のウェハ107に、例えばLSIパタン等の描画が行なわれる。

第2図(a)、(b)はウェハ107を保持するためのホルダ108及びその周辺の詳細を示すものであり、ホルダテーブル111は図示しない昇降機構により上下動が可能となっており、ホルダ搬送アーム116上に受け渡されたホルダ108を載置し得るようになっている。

第3図は、前記ホルダ108、ホルダテーブル111等をさらに詳細に示したものである。同図

に示すように、円筒状のホルダテーブル１１１内にはその中央部にウェハ吸着用通気孔３０２が形成され、該通気孔３０２の外周部には、該通気孔３０２と同軸状にウェハ吸着用通気孔３０１が形成されている。なお、ホルダ１０８上にはガイドピン３０８が突設されている。

前記ホルダ１０８内には、中心部及びこれに連通する外周部とから成る通気流路３０３が形成され、該通気流路３０３は前記ウェハ吸着用通気孔と連通しており、また、該ホルダ１０８内には静電電圧印加用の電極３０５が該ホルダ１０８の上面と略平行に形成されている。そして、該電極３０５には端子３０４が接続され、該端子３０４は前記ホルダ搬送アーム１１６の端子３０６と対向するようになっており、該端子３０６はホルダ搬送アーム１１６内の配線３０７に接続されている。

次に、上記実施例の動作を説明する。

ウェハ装填動作の当初では、ゲートバルブ１０６を開いておき、排気室１０４内は大気圧にしておく。この状態でウェハ搬送ロボット１０９を作動させ、ウェハカセット１１０から受け渡されたウェハ１０７をホルダ搬送アーム１１６上のホルダ１０８上に載置し、次いで、ホルダ搬送アーム１１６をゲートバルブ１０６を介して移動し、ホルダ１０８を前記排気室１０４内のホルダテーブル１１１上に載置させる。

次いで、前記ホルダテーブル１１１のホルダ吸着用通気孔３０１内を排気して負圧にし、該ホルダ１０８をホルダテーブル１１１上に負圧吸着力により保持（いわゆる真空チャック）させる。ここで、ホルダ１０８上のウェハ１０７の保持はホルダ１０８上のガイドピン３０８により所定の精度で行われる。

次に、前記ホルダテーブル１１１内のウェハ吸着用通気孔３０２及び前記ホルダ１０８内の通気流路３０３が排気されて負圧となり、ウェハ１０７はホルダ１０８上に負圧吸着力により保持され、かつ、十分な精度で平坦化される。例えば６インチのウェハでは最大１μｍの反り程度に矯正することができる。

その後、ホルダテーブル１１１を下方に移動する。これにより、端子３０４と端子３０６とが接触し、電極３０５に静電電圧が印加されると、ウェハ１０７は静電吸着力によりホルダ１０８上に保持される。この場合、ウェハ１０７は前記負圧吸着力の作用時に十分に平坦化されているので、ホルダ１０８上面との大きな接触面積が得られており、これによりウェハ１０７に作用する静電吸着力は十分大きなものとなっている。

続いて、ゲートバルブ１０６を閉じ、排気室１０４の排気を排気ポンプ１１２により行なう。該排気の進行に応じてウェハ１０７に作用する負圧吸着力は低減するが、ウェハ１０７に作用する静電吸着力は強く維持されている。また、排気室１０４の排気により、ホルダテーブル１１１とホルダ１０８との間に作用する負圧吸着力は殆ど消失するようになる。その後、ホルダテーブル１１１を下方に移動すると、ホルダ１０８はホルダ搬送アーム１１６上に単独で受け渡される。

前記排気室１０４内が十分に減圧されると、ゲートバルブ１０５が開かれ、ホルダ搬送アーム１１６はホルダ１０８に保持されたウェハ１０７を前記真空容器１０３内の試料ステージ１１４上に移送する。なお、該試料ステージ１１４内にも前記端子３０６、及び配線３０７と同様の静電電圧印加手段が設けられており、ウェハ１０７に対する静電吸着力の付与は常時行なわれている。

前記ホルダ搬送アーム１１６が前記真空容器１０３外に移動すると、ゲートバルブ１０５が閉じられ、ＬＳＩパターン等の描画が開始される。この描画が行われた後、再びゲートバルブ１０５が開かれ、ホルダ搬送アーム１１６の移動によりホルダ１０８を真空容器１０３から排気室１０４のホルダテーブル１１１の上方に位置させる。この際、ホルダテーブル１１１は前記下方への移動により最下方位置にある。

次に、ホルダテーブル１１１を上方に移動させてホルダ１０８の下面に接触させ、ゲートバルブ１０５を閉じた後、排気ポンプ１１２を停止させ

て、排気室１０４内が大気圧になるようにリークを開始する。続いて、ホルダ吸着用通気孔３０１内を排気してホルダ１０８をホルダテーブル１１１上に負圧吸着力により保持する。次いで、ホルダテーブル１１１を最上方位置に移動させると、静電電圧の印加は解除されている。

その後、ウェハ吸着用通気孔３０２とホルダ内の通気流路３０３を大気圧よりも若干高めの圧力に設定すると、ホルダ１０８からのウェハ１０７の剥離は容易に行なわれる。次に、ゲートバルブ１０６を開き、描画済みのウェハ１０７をウェハ搬送ロボット１０９により前記ウェハカセット１１０に移す。

このようにして１枚のウェハの描画処理を終了する。引き続き、次のウェハの処理を行なうには以上の動作を繰り返す。

なお、上記実施例の説明では説明を簡単にするために、例えば排気室１０４内の排気動作、ホルダ１０８のホルダテーブル１１１やホルダ搬送アーム１１６への受け渡し動作、さらにはウェハ１０７のホルダ１０８への受け渡し動作等の間は電子ビーム露光装置本来のパターン描画等の動作を停止させるようにしている。しかし、通常の場合、装置の生産性を向上させるべく、装置本来のウェハの加工動作と、次のウェハの装填動作との並行処理を行ない得る構成にしている。具体的には、例えば、排気室１０４と真空容器１０３との間に中間室を設け、該中間室に前記ホルダテーブル１１１を２台設置し、３つ以上のホルダ１０８を用いることとすれば、前記並行処理動作は容易に実現できる。

［発明の効果］

以上説明したように、請求項１の構成によれば、薄板状試料と保持部との間に静電吸着力を生じさせる電圧印加手段を設け、前記保持部に通気孔を形成し、該の一端側を前記試料に臨ませると共に、該の他端側に排気手段を連結したことを特徴とするので、薄板状試料を保持部に保持させる場合、静電吸着力だけででなく、負圧吸着力も作用させることができるので、薄板状試料はホルダに対して十分に平坦化された状態で保持される。従って、本発明に係る装填装置を用いた場合、該装填装置を搭載した装置本体では、薄板状試料は平坦化された形状の状態での加工処理が可能となるため、薄板状試料の加工処理の高精度化を実現できる。その結果、例えば、薄板状試料たるウェハに直接描画する電子ビーム露光装置などではウェハの高さ検出器や検出結果に基づくビーム照射位置の補正を不要にし、装置を簡単にすることができる。また、薄板状試料たるウェハを静電吸着力により強力に保持した後に発生しがちな、ウェハのホルダからの剥離動作不良といったトラブルを回避することができ、装置全体の信頼性向上に貢献する。

請求項２の構成によれば、試料と保持部との間に形成される空間部に負圧を生じさせて該試料を該保持部に保持し、次いで、該試料と保持部内の電極との間に所定の静電電圧を印加することを特徴とするので、請求項１の構成の効果に加え、負圧吸着力による保持の後に静電吸着力を試料と保持部との間に作用できるので、例えば試料装填の当初が大気圧雰囲気下で試料の加工処理が減圧雰囲気であるという通常の加工処理過程の場合、保持、矯正、加工という一連の加工処理操作を円滑に行うことができ、生産性の向上にさらに貢献できる。

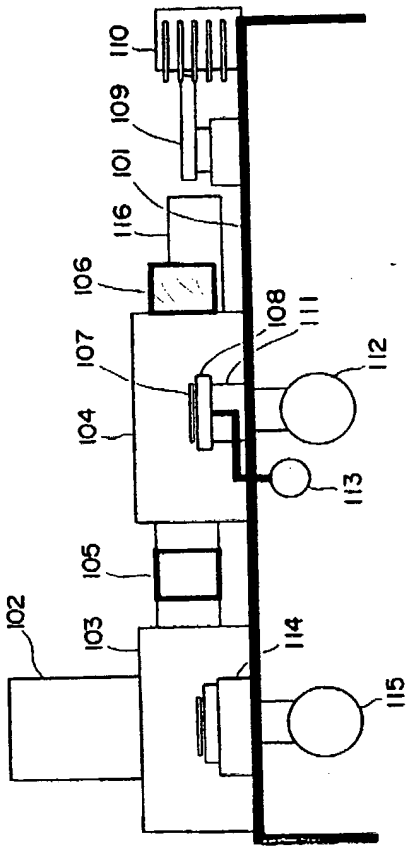
４．図面の簡単な説明

第１図は、電子ビーム露光装置に適用された場合の本発明の一実施例を示す側断面図であり、第２図（ａ）、（ｂ）は、ウェハ及び保持部、ホルダテーブル、ホルダ搬送アーム等の位置関係を示す図であり、第２図（ａ）はその平面図、第２図（ｂ）はその側面図、第３図は第２図（ｂ）の縦断面図である。

（符号の説明）

１０７…ウェハ（試料）、１０８…ホルダ（保持部）、３０３…通気流路、３０５…電極（電圧印加手段）、３０４、３０６…端子（電圧印加手段）、１１３…排気ポンプ（排気手段）。

第 1 図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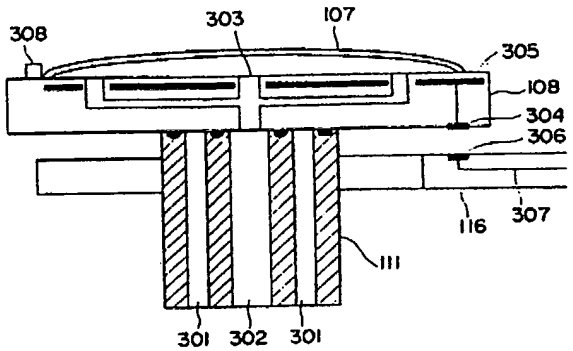
108
111
107
112
104
113
105
102
103
114
115

第 3 図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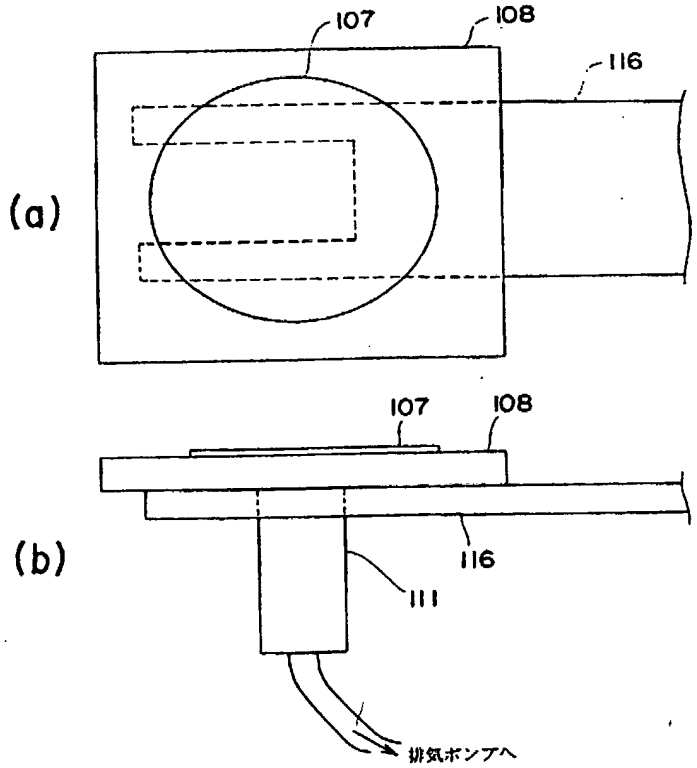
303
107
305
108
304
306
116
307
111
301
302
301

第 2 図


(a)
107
108
116
(b)
107
108
116
111
排気ポンプへ

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# SPECIFICATION

## 1. Title of the Invention: APPARATUS AND METHOD FOR MOUNTING SPECIMEN

## 2. Claims

(1) A specimen mounting apparatus characterized by comprising:

voltage applying means for generating an electrostatic attractive force between a laminar specimen and a holding section; and

a ventilation flow path formed in the holding section,

wherein one end side of the ventilation flow path is faced with the specimen, and evacuation means is connected to the other end side of the ventilation flow path.

(2) A specimen mounting method characterized by comprising:

generating a negative pressure in a space formed between a laminar specimen and a holding section, to hold the specimen on the holding section; and

subsequently applying an electrostatic voltage having a predetermined magnitude across the specimen and an electrode in the holding section.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention relates to a specimen mounting apparatus to be installed in, for example, an electron beam exposure system for rendering an LSI pattern or the like on a wafer serving as a laminar specimen, or a semiconductor processing system for performing wafer processing such as deposition or etching with respect to a wafer.

[Description of the Related Arts]

For example, in the electron beam exposure system, for the purpose of processing a wafer under a vacuum, there has hitherto been provided a specimen mounting apparatus for holding the wafer on a specimen stage by a spring force or an electrostatic attractive force (namely, by virtue of a so-called electrostatic chuck).

[Problems to be Solved by the Invention]

However, since such a specimen mounting apparatus uses only a spring force or an electrostatic attractive force, there is a limit to the force with which the specimen

mounting apparatus can hold the wafer. Therefore, even though the specimen mounting apparatus is merely capable of holding the wafer, it cannot exert an effect enough to flatten the wafer when the wafer has warpage that is required to be corrected.

This is because, depending on initial conditions in which the wafer is held on the holding section, for example, depending on whether the wafer is in a reduced pressure atmosphere or in an atmospheric air, how much the warpage of the wafer at the initial stage of holding is, or whether dust is present between the wafer and the holding section, the effective contact area contributing to the wafer holding significantly varies, and hence the electrostatic attractive force greatly varies.

For example, in the case of a specimen mounting apparatus configured to perform specimen holding using an electrostatic attractive force alone, e.g., when a wafer of 6 inches has warpage of 50 μm at maximum before being held, the specimen mounting apparatus can reduce the warpage only to nearly 40 μm at maximum even if 300 V is applied across the wafer and the holding section to generate an electrostatic attractive force.

Furthermore, in such a specimen mounting apparatus using an electrostatic attractive force alone, electric charges stay at an insulation section of the electrostatic

chuck even after the voltage application has been released, so that the wafer may be unable to easily separated from the wafer holding section due to a residual electrostatic force and/or by a residual effect of an attractive force between the wafer and the electrostatic chuck, the attractive force being based on an intermolecular attractive force.

The present invention has been made in order to solve the above-described problems. The object of the present invention is to provide a specimen mounting apparatus and a method therefor that are capable of increasing an attractive force between the specimen and the holding section, and also facilitating the mounting/dismounting of the specimen.

[Means for Solving the Problems]

To achieve the above-described object, the invention according Claim 1 is characterized by including voltage applying means for generating an electrostatic attractive force between a laminar specimen and a holding section; and a ventilation flow path formed in the holding section, wherein one end side of the ventilation flow path is faced with the specimen, and evacuation means is connected to the other end side of the ventilation flow path.

Also, the invention according Claim 2 is characterized by including generating a negative pressure in a space formed between a laminar specimen and a holding section, to hold the specimen on the holding section; and subsequently

applying an electrostatic voltage having a predetermined magnitude across the specimen and an electrode in the holding section.

[Operation]

In the arrangements of the present invention, typically, the evacuation means is firstly operated to place the inside of the ventilation flow path under a negative pressure, and to generate a negative suction force between the laminate specimen and the ventilation flow path, whereby the laminate specimen on the holding section is flattened. Next, a voltage is applied across the laminate specimen and the holding section to generate an electrostatic attractive force.

Thereafter, in order to separate the laminate specimen from the holding section, the above-described application of the voltage is released, and further the evacuation means is operated to place the ventilation flow path under a positive pressure.

[Embodiment]

Fig. 1 shows an example of electron beam exposure system equipped with the specimen mounting apparatus according to the present invention. This electron beam exposure system is configured to directly perform rendering on a wafer 107 serving as the laminate specimen.

Specifically, on a vibration isolation base 101, there

are provided a vacuum container 103 having an electro-optic barrel 102, an evacuation chamber 104, a wafer transfer robot 109, a wafer cassette 110, and so on. The vacuum container 103 and the evacuation chamber 104 are connected with each other through a gate valve 105, and the evacuation chamber 104 has a gate valve 106. A holder transfer arm 116 is movably installed between the vacuum container 103 and the evacuation chamber 104. The wafer transfer robot 109 is configured to be able to perform the delivery/receipt of the wafer 107 between the wafer cassette 110 and the holder transfer arm 116.

An evacuation pump 115 is connected to the vacuum container 103, which has a specimen stage 114 provided therein. Also, an evacuation pump 112 is connected to the evacuation chamber 104, which has a holder table 111 arranged therein. On the holder table 111, a holder 108 serving as a holding section can be placed. An evacuation pump 113 serving as evacuation means is connected to the holder 108.

In the vacuum container 103, e.g., an LSI pattern or the like is rendered on the wafer 107 on the holder 108 arranged on the specimen stage 114.

Figs. 2(a) and 2(b) show details of the holder 108 for holding the wafer 107 thereon and its peripherals. The holder table 111 is configured to be able to be moved up and

down by an ascent/decent mechanism (not shown), and to place thereon the holder 108 delivered onto the holder transfer arm 116.

Fig. 3 shows the holder 108, the holder table 111, and the like in more detail. As shown in Fig. 3, in the cylindrical holder table 111, a wafer suction vent 302 is formed in the center portion thereof. In an outer periphery of the vent 302, a wafer suction vent 301 is formed coaxially with the vent 302. Also, a guide pin 308 is projected from the holder 108.

In the holder 108, there is provided a ventilation flow path 303 constituting a center portion and its outer periphery communicating therewith, and the ventilation flow path 303 communicates with the above-described wafer suction vent. Furthermore, in the holder 108, an electrode 305 for use in electrostatic voltage application is formed substantially in parallel with the top surface of the holder 108. A terminal 304 is connected to the electrodes 305, and opposed to a terminal 306 of the holder transfer arm 116. The terminal 306 is connected to wiring 307 in the holder transfer arm 116.

Next, operations of the above-described embodiment will be described.

At the initial stage of wafer mounting operation, the gate valve 106 is opened, and the inside of the evacuation

chamber 104 is placed under an atmospheric pressure. In this state, the wafer transfer robot 109 is operated to place the wafer 107 delivered from the wafer cassette 110 on the holder 108 on the holder transfer arm 116. Then, the holder transfer arm 116 is moved via the gate valve 106 to place the holder 108 on the holder table 111 in the evacuation chamber 104.

Thereafter, the inside of the holder suction vent 301 in the holder table 111 is evacuated to a negative pressure, whereby the holder 108 is held on the holder table 111 by a negative pressure suction force (namely, by virtue of a so-called vacuum chuck). Here, the holding of the wafer 107 on the holder 108 is performed by the guide pin 308 on the holder 108 with a predetermined accuracy.

Next, the inside of each of the wafer suction vent 302 in the holder table 111 and the ventilation flow path 303 in the holder 108 is evacuated to a negative pressure, whereby the wafer 107 is held on the holder 108 by a negative pressure suction force, and simultaneously, it is flattened with sufficient accuracy. For example, for the wafer of 6 inches, its warpage can be reduced to the level of 1 μm at maximum.

Thereafter, the holder table 111 is moved downward, and when the terminal 304 and terminal 306 make contact with each other, an electrostatic voltage is applied to the

electrode 305. Thereupon, the wafer 107 is held on the holder 108 by an electrostatic attractive force. In this situation, since the wafer 107 has been sufficiently flattened by the negative pressure suction force operated thereon, the wafer 107 has obtained a large contact area with the top surface of the holder 108. This has made the electrostatic attractive force operating on the wafer 107 sufficiently large.

Then, the gate valve 106 is closed, and the inside of the evacuation chamber 104 is evacuated by the evacuation pump 112. The negative pressure suction force operating on the wafer 107 decreases as the evacuation progresses, whereas the electrostatic attractive force operating on the wafer 107 is still kept strong. Here, the evacuation of the evacuation chamber 104 causes the negative pressure suction force operating between the holder table 111 and gate valve 106 to be substantially disappear. Thereafter, upon moving the holder table 111 downward, the holder 108 is singly delivered onto the holder transfer arm 116.

When the inside of the evacuation chamber 104 is sufficiently depressurized, the gate valve 105 is opened, and the holder transfer arm 116 transfers the wafer 107 held by the holder 108 onto the specimen stage 114 in the vacuum container 103. Also in the specimen stage 114, there is provided electrostatic voltage applying means like the

terminal 306 and the wiring 307, and the impartment of an electrostatic attractive force to the wafer 107 is always performed.

When the holder transfer arm 116 moves outside the vacuum container 103, the gate valve 105 is closed, and rendering of an LSI pattern or the like is started. After the rendering has been performed, the gate valve 105 is again opened, and the holder 108 is moved from the vacuum container 103 to a position above the holder table 111 in the evacuation chamber 104 by a movement of the holder transfer arm 116. At this time, the holder table 111 is located at the lowermost position thereof due to the above-described downward movement thereof.

Next, the holder table 111 is moved upward to make contact with the bottom surface of the holder 108. Then, after having closed the gate valve 105, the evacuation pump 112 is stopped, and leakage is started so that the inside of the evacuation chamber 104 becomes an atmospheric pressure. Then, the inside of the holder suction vent 301 is evacuated to hold the holder 108 on the holder table 111 by a negative pressure suction force. Thereafter, when the holder table 111 is moved to the uppermost position thereof, the application of the electrostatic voltage has been released.

After that, when the pressure in the wafer suction vent 302 and the ventilation flow path 303 in the holder is set

to be a pressure somewhat higher than the atmospheric pressure, the separation of the wafer 107 from the holder is easily performed. Next, the gate valve 106 is opened, and the wafer 107 that has been subjected to rendering is transferred to the wafer cassette 110 by the wafer transfer robot 109.

In this manner, rendering processing with respect to one wafer is completed. In order to subsequently perform processing with respect to a next wafer, the above-described operations are repeated.

In the above-described explanation of the embodiment, for the sake of simplification of description, for example, during the evacuating operation with respect to the inside of the evacuation chamber 104, the delivery operation of the holder 108 to the holder table 111 or the holder transfer arm 116, and further the delivery operation of the wafer 107 to the holder 108, the original operation of the electron beam exposure system, such as pattern rendering, is brought to a halt. However, in ordinary practice, in order to improve the productivity of the system, the system is arranged to be able to perform concurrent processing between original wafer working of the system and the mounting of a subsequent wafer. Specifically, for example, by providing an intermediate chamber between the evacuation chamber 104 and the vacuum container 103, arranging two of the above-

described holder tables 111 in this intermediate chamber, and using three or more holders 108, the above-described concurrent processing operations can be easily implemented.

[Advantages]

As described above, according to the construction as recited in Claim 1, the specimen mounting apparatus is characterized by including voltage applying means for generating an electrostatic attractive force between a laminar specimen and a holding section; and a ventilation flow path formed in the holding section, wherein one end side of the ventilation flow path is faced with the specimen, and evacuation means is connected to the other end side of the ventilation flow path. Therefore, when a laminar specimen is held on the holding section, not only an electrostatic attractive force but also a negative pressure suction force is allowed to operate on, so that the laminar specimen is held on the holder in a state of being sufficiently flatten. Hence, when the mounting apparatus according to the present invention is used, the electron beam exposure system equipped with this mounting apparatus allows the laminar specimen to be subjected to work processing in a flattened shape, thereby enabling the achievement of high-accuracy work processing of laminar specimen. As a result, in the electron beam exposure system or the like, which performs rendering directly on the wafer

serving as a laminar specimen, it is possible to eliminate the need for a wafer height detector or the correction of a beam irradiation position based on a detection result, thereby allowing the simplification of the system. It is further possible to avoid a trouble such as a poor separation, from the holder, of the wafer serving as a laminar specimen, the separation being prone to occur after the wafer serving as a laminar specimen has been strongly held by an electrostatic attractive force. This avoidance of the poor separation contributes to improved reliability of the entire system.

According to the construction as recited in Claim 2, the specimen mounting method is characterized by including generating a negative pressure in a space formed between a specimen and a holding section, to hold the specimen on the holding section; and subsequently applying an electrostatic voltage having a predetermined magnitude across the specimen and an electrode in the holding section. Therefore, in addition to the effect of the construction according to the Claim 1, an electrostatic attractive force can be operated between the specimen and the holding section after the specimen has been held by a negative pressure suction force. Hence, for example, in usual working processes, in which the initial stage of specimen mounting is performed under an atmospheric pressure environment, and in which the work

processing of specimen is performed under a reduced pressure environment, a series of work processing operations such as holding, correction, and working can be smoothly performed. This can further contribute to enhanced productivity.

4. Brief Description of the Drawings

Fig. 1 is a sectional side view showing an embodiment according to the present invention, wherein the embodiment is applied to an electron beam exposure system. Figs. 2(a) and 2(b) are diagrams showing the positional relationships among a wafer and holder section, a holder table, a holder transfer arm, wherein Fig. 2(a) is a plan view of the embodiment, and Fig. 2(b) is a side view thereof. Fig. 3 is a longitudinal sectional view of the embodiment shown in Fig. 2(b).

[Reference Numerals]

107: wafer (specimen)

108: holder (holding section)

303: ventilation flow path

305: electrode (voltage applying means)

304 and 306: terminals (voltage applying means)

113: evacuation pump (evacuation means)

FIG. 2(b)

TO EVACUATION PUMP